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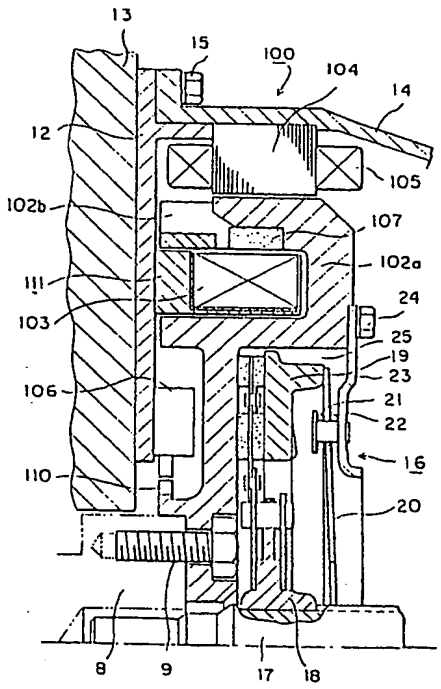
(54) **STARTER/CHARGER OF ENGINE.**

(57) In a starter/charger (100) of an engine disposed between an engine main body (13) and a clutch (16), the present invention stores the principal portion of the clutch (16) in a recess formed in an axial direction on the end surface of a rotating field magnetic pole (102a) on the clutch side. Therefore, the axial length from the engine (13) to the clutch (16) can be reduced and the starter/charger can be mounted easily even to vehicles not having a sufficient length in the axial direction of the engine, such as a transverse engine type car.

FIG. 2



EP 0 311 688 A1

ENGINE STARTING AND CHARGING DEVICE

FIELD OF THE INVENTION

The present invention relates to an engine starting and charging device that a starting motor for starting an engine and a charging generator driven by the engine to charge a battery are formed as a unit.

BACKGROUND OF THE INVENTION

An engine starting and charging device including a starting motor and a charging generator as one unit has been suggested as a prior art, for example, one disclosed in Laid-Open Japanese Patent No. Sho 61-54949.

Fig. 1 is a sectional view of a prior-art engine starting and charging device disclosed in Laid-Open Japanese Patent No. Sho 61-54949. In Fig. 1, a starting and charging device body 1 comprises revolving field poles 2a, 2b, a field coil 3, an armature core 4, an armature coil 5, and a crank angle detector 6 as major components.

The revolving field poles 2a, 2b are a pair of comb-shaped field poles produced of a ferromagnetic material, which are coupled as a unit through a ring 7 of a non-magnetic material such that their magnetic pole sections are arranged alternately in the circumferential direction. The field pole 2a, functioning as a flywheel and also as a clutch carrier described later, is mounted

on an engine crankshaft 8, and fixed on the end of the crankshaft 8 by a bolt 9. Numeral 10 is a cutout formed at the side section of the field pole 2a, which, combined with the crank angle detector 6, is used to detect the crank angle; the same number of cutouts as the number of magnetic poles of the field pole 2a are provided at equal intervals around the circumference. The width of the cutout 10 in the circumferential direction makes an angle equal to about one half of 360 degrees divided by the number of the cutouts.

The field coil 3, which is for exciting the field poles 2a, 2b, is mounted on the field core 11. This field core 11 is mounted and fixed to a bracket 12 by bolts, which are not illustrated, facing the field poles 2a, 2b, across slight air gaps a, b in the radial direction.

The armature core 4 is formed by laminating silicon steel sheets, within the inner periphery of which are provided a number of slots for setting the armature coil 5 therein, the armature coil 5 being of a three-phase distributed winding type as a common commutatorless motor. The armature core 4 is properly positioned and fixed in relation to the bracket 12, which is secured by bolts 15 to an engine body 13 together with a housing 14 for securing the armature core 4.

The crank angle detector 6 functions as a signal source that operates an armature current switching circuit

which is not illustrated, and uses an oscillation-type proximity switch. This proximity switch is so mounted on the bracket 12 that its detecting element faces on the circumferential line where the cutouts 10 of the field pole 2a are provided, and its oscillating conditions vary with the change of inductance at the cutout and non-cutout sections of the field pole 2a, outputting a binary signal "1" and "0" corresponding to the crank angle (field pole position). When a three-phase armature coil 5 is employed, there will be installed three crank angle detectors 6.

Numeral 16 is a clutch which interrupts the transmission of power between the crankshaft 8 and a transmission drive shaft 17, and uses a diaphragm spring clutch comprising a clutch disc 18, a pressure plate 19, a diaphragm spring (disc spring) 20, wire rings 21, 22, and a clutch cover 23. The clutch cover 23 is mounted by bolts 24 to the field pole 2a.

The clutch 16, as is well known, is of such a constitution that when a clutch pedal (not illustrated) is not depressed, the tension of the diaphragm spring 20 is exerted, by leverage, to the clutch disc 18 mounted on the transmission drive shaft 17 through the pressure plate 19, pressing this clutch disc 18 against the side of the field pole 2a to connect the clutch.

When the clutch pedal is depressed, the sleeve, which is not illustrated, slides in the axial direction,

pressing the central part of the diaphragm spring 20 in the direction of the arrow C. Therefore the diaphragm spring 20 deflects back on the wire rings 21, 22 as a fulcrum, thus removing a pressure that has been exerted to the clutch disc 18 to disconnect the clutch, and accordingly shutting off the transmission of power from the crankshaft 8 to the transmission drive shaft 17.

Subsequently, the operation of the starting and charging device of the above-mentioned constitution will be described. When the key switch, which is not illustrated, is turned to the START position, with the engine left stationary, the current flows into the field coil 3 and the armature coil 5, thereby producing a torque at the field poles 2a, 2b to turn the crankshaft 8 directly coupled. When the field poles 2a, 2b have started turning, the crank angle detector 6 detects the positions of the field poles, and the armature current switching circuit switches the current to the armature coil 5 so that the speed of a rotating field formed by the armature coil 5 will be the same as the speed of rotation of the field poles; accordingly the field poles 2a, 2b will gain a torque for further acceleration. The device, thus producing a starting torque by such a positive feedback operation, starts the engine.

After the engine has started, the speed of rotation of the field poles further increases, thus increasing a back electromotive force produced at the armature coil 5; accordingly no unnecessary starting current will flow.

Furthermore, when, after the starting of the engin , the key switch is placed in the IGNITION position, the starting and charging device body 1 operates as an a.c. synchronous generator, which produces the electric power. The electric power thus produced is converted into d.c. power by means of a rectifier which is not illustrated, and supplied to the battery and electrical equipment mounted on the motor vehicle.

As described above, the prior-art starting and charging device body 1 is disposed between the engine body 13 and the clutch 16. However, since the engine crankshaft 8 and the transmission drive shaft 17 are usually disposed in series, the engine becomes longer in the axial direction than in the radial direction; particularly in an automobile mounted with a horizontal engine which has little dimensional room in the axial length, it is difficult to mount the starting and charging device between the engine body 13 and the clutch 16.

In the case of an engine equipped with a special starting motor and a charging generator, these equipment are mounted in parallel in relation to the engine body. Therefore, there is such a problem that the application of the aforementioned prior-art starting and charging device to such an engine requires a substantial modification in the arrangement of various parts of the engine.

SUMMARY OF THE INVENTION

The present invention has been accomplished in an attempt to solve the above-mentioned problems, and has an object to provide an engine starting and charging device which enables the reduction of size in the axial direction of the engine equipped with a starting and charging device, so that the device may easily be applied to motor vehicles that are restricted by dimensions.

The engine starting and charging device pertaining to the present invention has at least a clutch disc and a pressure plate of clutch set in a recess defined in the axial direction of the revolving-field poles.

In the present invention, because major component members of the clutch are disposed in the recess of the revolving-field poles, the length in the axial direction from the starting and charging device to the clutch can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of a prior-art starting and charging device of engine; and

Fig. 2 is a sectional view showing a starting and charging device of engine according to one embodiment of the present invention.

BEST MODE OF THE INVENTION

A preferred embodiment of the present invention will now be described by referring to the accompanying drawings. Fig. 2 is a sectional view of the starting and charging device of engine in accordance with one embodiment of the present invention. In Fig. 2, numeral 100 is a starting and charging device body, which is constituted of such major components as a revolving-field poles 102a, 102b, a field coil 103, a field core 111, an armature core 104, an armature coil 105, and a crank angle detector 106. These components correspond to the revolving-field poles 2a, 2b to the field core 11 in the device of prior art.

The revolving-field pole 102a has a recess 25 formed in the axial direction in the own end on the clutch 16 side. In this recess 25 is disposed the clutch 16. The constitution of this clutch 16 and the constitution of aforementioned other components are similar to those of the prior-art device of Fig. 1, and therefore the same numerals are attached to corresponding parts, the explanation of which, therefore, will be omitted.

In the engine starting and charging device of such constitution, since the clutch 16 is disposed within a recess 25 of the revolving-field pole 102a, the axial length of only the starting and charging device body 100 is enough for holding both the starting and charging

device body and the clutch 16. That is, because of the parall l arrangement of the starting and charging device 100 and the clutch 16 in relation to the crankshaft 8, it is possible to reduce the length of these devices in the axial direction.

Engine starting, battery charge, and clutch 16 operation, being identical to those of the prior art, will not be described herein.

According to the above-mentioned embodiment, the entire body of the clutch 16 is set in the recess 25 of the revolving-field pole 102a, but particularly only its major parts, such as the clutch disc 18 and the pressure plate 19, may be disposed therein.

The size in the axial direction of the engine can be decreased by mounting the crank angle detector 106 which detects the angle of rotation of the revolving-field pole 102a on the bracket 12 corresponding to the recess of the revolving-field poles such that the amount of projection in the axial direction of the crankshaft and by forming a recess in the end of the revolving-field poles in the axial direction on the clutch side.

WHAT IS CLAIMED IS:

1. An engine starting and charging device having a starting and charging device body which comprises revolving-field poles mounted on a crankshaft of engine and functioning as a carrier of a clutch for connection and disconnection between said crankshaft and a transmission drive shaft, field coils which excite said revolving-field poles, an armature core secured on an engine body, and an armature coil wound thereabout, characterized in that a recess is formed in the axial direction in the end of said revolving-field poles on the clutch side, and in the recess are disposed at least a clutch disc of said clutch which contacts said revolving-field poles, and a pressure plate of said clutch which presses said clutch disc toward the revolving-field pole side.

2. An engine starting and charging device as claimed in claim 1, wherein said field core is secured on a bracket and said armature core is secured on a housing.

3. An engine starting and charging device as claimed in claim 1, wherein said bracket and housing are attached to the engine body by common bolts.

4. An engine starting and charging device having a starting and charging device body which comprises revolving-field poles mounted on a crankshaft of engine and functioning as a carrier of a clutch for connection and disconnection between said crankshaft and a transmission drive shaft, field coils which excite said revolving-field poles, an armature core secured on an engine body, and an armature coil wound thereon; and a crank angle detector which detects the angle of rotation of said revolving-field poles, and changes the direction of flow of the electric current in said armature coil such that, in accordance with the detection signal, said armature coil will form a revolving field having a fixed phase difference in relation to the magnetic field of said revolving-field poles, characterized in that there is formed a recess in the axial direction in the end of said revolving-field poles on the clutch side, and in this recess are disposed at least a clutch disc of said clutch which contacts said revolving-field poles, and a pressure plate of said clutch which presses said clutch disc against the revolving-field pole side.

5. An engine starting and charging device as claimed in claim 4, wherein said crank angle detector is mounted on a bracket opposite to the recess of said revolving-field poles such that the amount of projection in the axial direction of said crankshaft will become the least.

FIG. 1

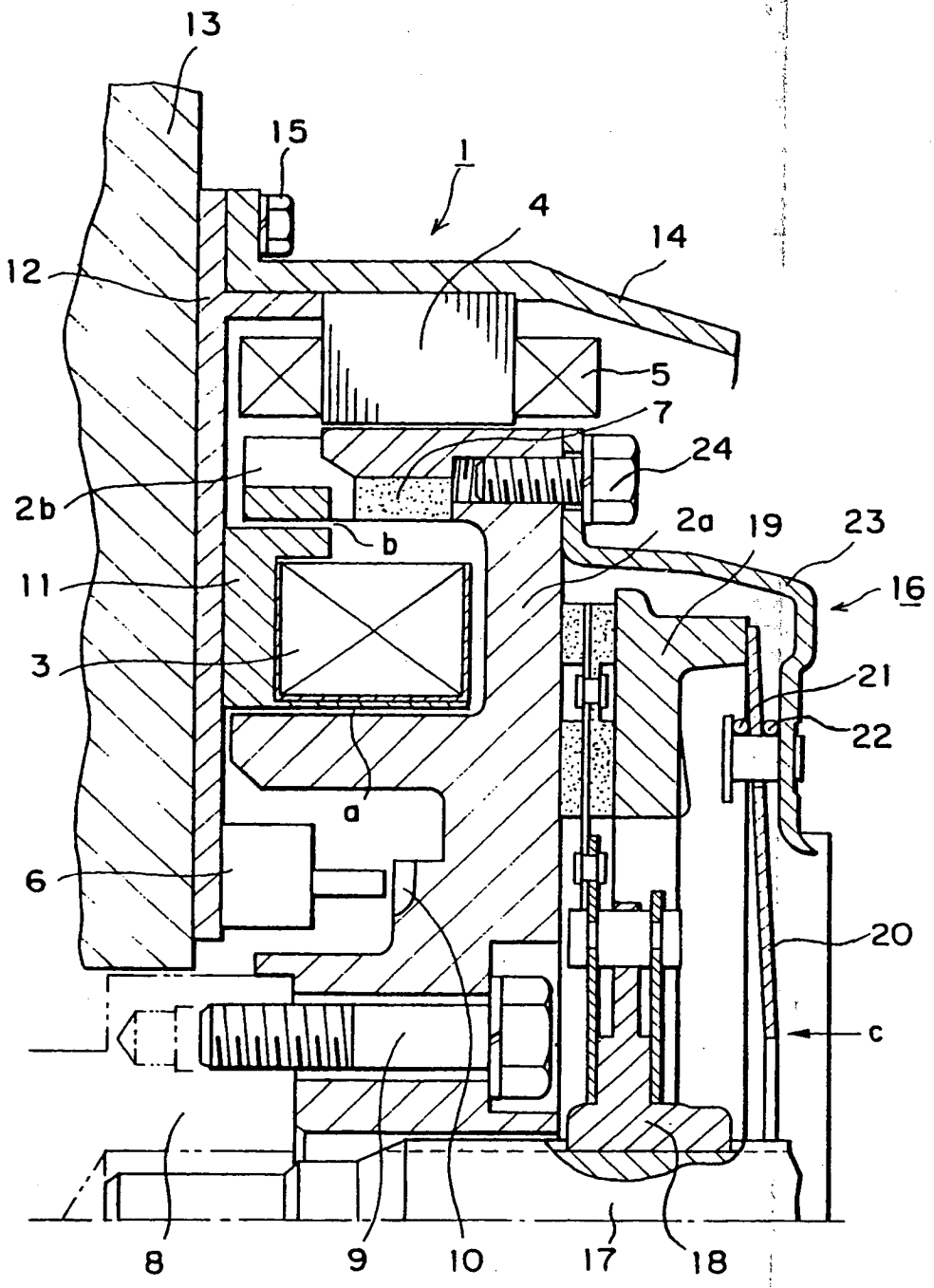
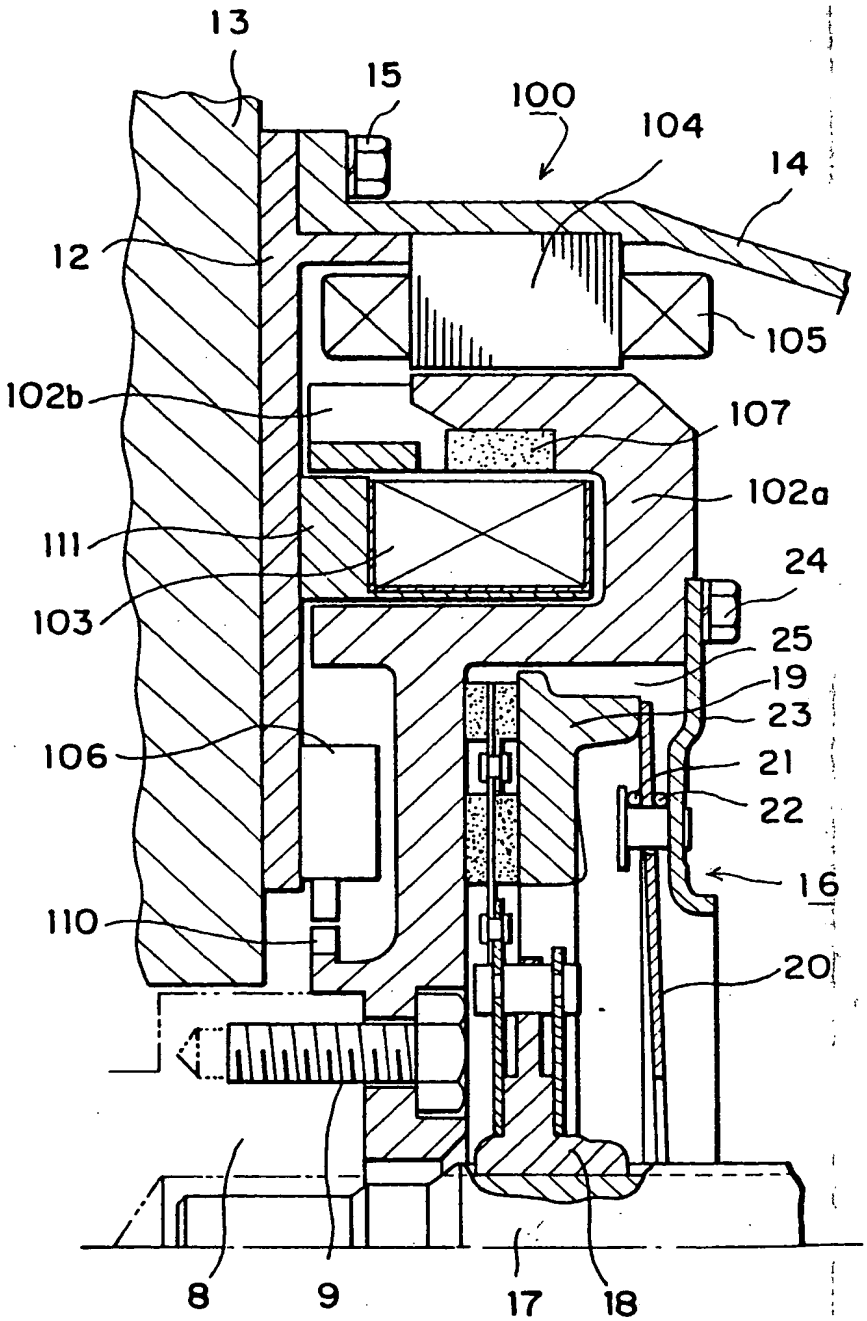


FIG. 2



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP88/00126

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl[4] H02K7/10

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System [5]	Classification Symbols
IPC	H02K7/10-7/18, F02N11/00, 11/02

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

Jitsuyo Shinan Koho 1939 - 1987
Kokai Jitsuyo Shinan Koho 1971 - 1987

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	JP, B2, 61-54949 (Nissan Motor Co., Ltd.) 25 November 1986 (25. 11. 86) Column 5, lines 7 to 36, Fig. 2 (Family: none)	1-5
Y	JP, A, 61-154463 (Mazda Motor Corporation) 14 July 1986 (14. 07. 86) P.2, lower left column, line 19 to lower right column, line 17, Fig. 1 (Family: none)	1-5

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
April 15, 1988 (15. 04. 88)	May 2, 1988 (02. 05. 88)
International Searching Authority [1]	Signature of Authorized Officer [20]
Japanese Patent Office	